



## **WATER RESOURCES RESEARCH GRANT PROPOSAL**

**Project ID:** 2005CO113B

**Title:** Hydrologic Analysis, Forecasting and Simulation of the Upper Colorado River System

**Project Type:** Other

**Focus Categories:** Hydrology, Models, Water Quantity

**Keywords:** hydrology, Colorado River

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**Non-Federal Matching Funds:** \$0

**Congressional District:** 4

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### **Abstract**

Hydrologic Analysis and Simulation of the Upper Colorado River System

#### **Problem**

The severe drought in the western United States in the past few years has reminded us how vulnerable water users in the state are to the variability of water supply. Many rivers of the state including the Colorado River system reached record or near record low flows causing widespread shortages and impacts to municipal water supply, agriculture, etc. Federal and state agencies (e.g. the U.S. Bureau of Reclamation, Colorado River Water Conservation District) have been looking for better ways of analyzing and modeling the temporal and spatial variability of the Colorado River streamflows. The current procedures for analyzing the streamflows (e.g. based on the so-called index sequential techniques) rely completely on the observed historical records and may give an optimistic view of future flows, which in turn could lead to unanticipated water shortages. These unexpected shortages would add an unnecessary burden to the people of the state during periods of extreme droughts. Therefore, it is critical that the most appropriate models be used to predict the long-term yield of the Colorado River Basin.

## Objectives

The scope of this research is to improve our understanding of the variability of streamflows in the upper Colorado River system in order to have better flow simulation capabilities including: (1) Improve the hydrologic data base for the upper Colorado River so that it includes records up through the current drought. (2) Explore the possibility of using reconstructed flow data from tree ring records to extend the flow records back from the year 1906 to provide a better understanding of the multidecadal flow patterns of the upper Colorado River system and will allow for a better assessment of the long term flow trend of the system. (3) Develop a stochastic model for simulating annual streamflows in the upper Colorado River System that reflects historic conditions. (4) Use the statistical parameters from the stochastic model to simulate conditions on the Colorado River in order to evaluate current operating procedures.

## Methods

Locate existing data regarding the variability of naturalized streamflows beyond 1996. If naturalized flows are not available, obtain the necessary data to calculate the naturalized flows. (1) Explore tree ring data and previously reconstructed flows (1520 C.E. to 1961 C.E. to provide longer historical view of the streamflow. (2) Analyze the updated streamflow database in order to build a stochastic model that will enable the simulation of monthly and annual synthetic streamflow data using Stochastic Analysis, Modeling, and Simulation (SAMS) software. The model should be capable of simulating flow traces that reflect the temporal and spatial variability of the historic data. (3) Use RiverWare (developed by the USBR and CADSWES) to model the behavior of the Colorado River with the statistical parameters generated by SAMS. Optimize operational procedures by analyzing different scenarios applied to the RiverWare model. (4) Compile findings in a research paper that will be submitted to the CRWCD.